I. QUALITY ASSURANCE

1. ASTM A325 AND A490 BOLTS, NUTS AND WASHERS SHALL BE TESTED BY CONTRACTOR. SUCH TESTING SHALL BE IN ADDITION TO TESTING REQUIRED OF MANUFACTURER IN PART III.K.10 OF THIS SPECIFICATION. SAMPLING, INSPECTIONS AND TESTING SHALL BE BY THE SHIPPING LOT METHOD, TAKEN FROM FASTENER COMPONENTS ACTUALLY DELIVERED TO THE CONSTRUCTION SITE.
   a) CHEMICAL ANALYSIS (A751) IS NOT REQUIRED. PROOF LOAD TESTING (F606) SHALL BE ACCOMPLISHED FOR EACH LOT OF EACH GRADE, SIZE AND TYPE OF EACH FASTENER COMPONENT.
   b) PROOF LOAD TESTING SHALL BE CONDUCTED ON FULL-SIZE BOLTS AND COMPONENTS, NOT ON MACHINED TEST SPECIMENS.
   c) PROOF LOAD TESTING SHALL BE ACCOMPLISHED USING METHOD 1 (LENGTH MEASUREMENT) OF METHOD F606.
   d) TESTING SHALL INCLUDE BOTH HARDNESS AND TENSILE STRENGTH.
   e) ADDITIONALLY, PROVIDE ALL OTHER TESTING STIPULATED AS MANDATORY UNDER THE ASTM SPECIFICATION.
2. BOLT INSTALLATION SHALL BE IN ACCORD WITH THE PROVISIONS OF THIS SPECIFICATION AND IN NO CASE LESS THAN THE BEST INDUSTRY PRACTICE.
   a) CONTRACTOR SHALL PROVIDE AND SHALL MAINTAIN IN GOOD CONDITION A SKIDMORE WELHELM BOLT TENSION CALIBRATOR (OR OTHER DEVICE ACCEPTED BY THE ENGINEER) AT EACH LOCATION WHERE HIGH-STRENGTH BOLTS ARE BEING TENSIONED. CONTRACTOR SHALL TEST REGULARLY:
      i) BOLT, NUT, WASHER AND LUBRICANT ASSEMBLIES FOR THE ACHIEVEMENT OF PROPER TENSION; AND
      ii) THE COMPETENCE AND UNDERSTANDING OF BOLTING CREWS FOR EACH METHOD OF TENSIONING BOLTS FOR EACH SIZE AND GRADE EMPLOYED IN THE WORK.

J. JOB CONDITIONS

1. CONSTRUCTION SEQUENCE: DESCRIPTIONS OF LIMITATIONS ON CONSTRUCTION SEQUENCE ARE INTENDED TO ASSIST CONTRACTOR IN COORDINATING THE WORK OF THE CONTRACT. DESCRIPTIONS DO NOT DESCRIBE FULLY THE LIMITATIONS GIVEN, DO NOT DESCRIBE ALL LIMITATIONS, NOR DO THEY PRECLUDE CONSTRUCTION SEQUENCES NOT CONTEMPLATED HEREIN. WHETHER OR NOT CONTRACTOR FOLLOWS THE LIMITATIONS ON CONSTRUCTION SEQUENCE DESCRIBED HEREIN, AND UNTIL SUCH TIME AS THE STRUCTURAL WORK IS COMPLETED, CONTRACTOR REMAINS FULLY RESPONSIBLE FOR BOTH THE STABILITY AND THE SAFETY OF THE WORK; ADHERENCE TO THE LIMITATIONS DESCRIBED HEREIN DOES NOT RELIEVE CONTRACTOR FROM THAT RESPONSIBILITY.

K. MATERIALS

1. STRUCTURAL STEEL FURNISHED FOR EACH LOCATION SHALL PROVIDE THE MINIMUM YIELD POINT GIVEN IN THE CONTRACT DRAWINGS, SHALL CONFORM TO THE APPLICABLE ASTM STEEL SPECIFICATION, SHALL MEET THE REQUIREMENTS OF *BUILDING CODE*, SHALL BE SUITABLE FOR USE IN WELDED STRUCTURES AND SHALL MEET THE REQUIREMENTS BOTH OF THE CONTRACT DRAWINGS AND OF THIS SPECIFICATION. ALL MATERIAL SHALL BE NEW AND OF BEST COMMERCIAL QUALITY. STEELS PRODUCED TO MODIFIED ASTM SPECIFICATIONS SHALL NOT BE USED WITHOUT WRITTEN ACCEPTANCE. EXCEPT WHERE SPECIFIC PRODUCTS ARE GIVEN IN THE CONTRACT DRAWINGS OR IN THIS SPECIFICATION, STRUCTURAL STEEL USED IN THE WORK MAY BE CHOSEN BY CONTRACTOR FROM THE APPLICABLE SPECIFICATIONS LISTED IN *AISC SPECIFICATION* AND ACCEPTED BY BOTH *BUILDING CODE* AND BY THE ENGINEER.
2. CONTRACTOR, IN ORDERING MATERIALS FROM MANUFACTURERS AND VENDORS, SHALL ENSURE THAT THE MANUFACTURER OR VENDOR UNDERSTANDS FULLY THE INTENDED USE OF THE AS-FABRICATED AND AS-ERECTED WORK. PURCHASE ORDERS SHALL IDENTIFY THE END USE OF PURCHASED MATERIALS. EXAMPLES OF END USE INCLUDE:
   a) TRUSS CORDS AND WEB MEMBERS
   b) BUILT-UP MEMBER FLANGES AND WEBS
   c) COLUMNS
   d) TENSION MEMBERS
   e) ELEMENTS OF RIGID FRAMES
   f) ALL ELEMENTS IDENTIFIED SPECIFICALLY IN DRAWINGS
   g) ALL SPECIAL AND SENSITIVE AREAS OF THE WORK

   PARTICULAR CARE SHALL BE TAKEN TO IDENTIFY MATERIALS:

   h) STRESSED IN TENSION TRANSVERSE TO THE GRAIN (RIGID FRAMES, TRUSSES, ETC.)

   IT IS THE INTENT OF THESE PROVISIONS TO ASSIST PRODUCER IN THE SELECTION OF MATERIALS BEST SUITED FOR THE INTENDED PURPOSE.
3. UNLESS NOTED SPECIFICALLY AS NOT CARRYING TENSILE LOADS OR DETAILED AS BOLTED, ALL STEELS AND PRODUCTS SELECTED FOR USE IN THE WORK SHALL BE SUITABLE FOR USE AS TENSION MEMBERS, CONNECTED BY WELDING.
4. SHOP AND FIELD-APPLIED PAINT SHALL BE PROVIDED WHERE DESIGNATED IN THE CONTRACT DRAWINGS, SPECIFIED HEREIN, AND WHERE REQUIRED BY *BUILDING CODE*. PAINT MATERIALS SHALL BE FULLY COMPATIBLE WITH FIREPROOFING AND OTHER MATERIALS IN CONTACT WITH THE PAINT AND SHALL BE SELECTED FROM THE FOLLOWING:
   a) SHOP PRIMER AND FIELD TOUCH-UP:
      i) TNEMEC 10-99, TNEMEC CO., INC.
      ii) CARBOLINE GP-818, CARBOLINE INC.
      iii) DUPONT 681-FD, RED OXIDE, DUPONT CO.
      iv) OTHER WHERE ACCEPTED
   b) ZINC-RICH:
      i) TNEMEC 90-96, TNEMEC CO. INC.
      ii) CARBOLINE CARBOZINC 11 HS, CARBOLINE INC.
      iii) GANCIN 347 WB, DUPONT CO.
      iv) OTHER CLASS A OR BETTER COATING, AS DEFINED BY AISC, WHERE ACCEPTED
   c) ALUMINUM PASTE VARNISH SHALL CONSIST OF 2 LBS OF ALUMINUM PASTE PIGMENT (ASTM D 962-66, TYPE 2, CLASS B) PER GALLON (240 G PER LITER) OF ALKYD VARNISH (FEDERAL SPECIFICATION TT-V-8, TYPE II).
5. GALVANIZED STEEL: WHERE REQUIRED TO BE GALVANIZED, MEMBERS SHALL BE HOT-DIPPED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123 OR TO ASTM A153 (TABLE 1), AS APPLICABLE. GALVANIZING SHALL EQUAL OR EXCEED 2 OZ. PER SQUARE FOOT (600 G/M²) OF SURFACE.
6. GALVANIZING TOUCH-UP: PROVIDE ORGANIC, ZINC-RICH PAINT:
   a) TNEMEC 90-97
   b) CARBOLINE 858, CARBOLINE INC.
   c) PPG INDUSTRIES NO. 97-670, PPG INDUSTRIES
   d) OTHER WHERE ACCEPTED
7. WELDING MATERIALS SHALL BE AS REQUIRED BY AWS FOR CONDITIONS OF INTENDED USE AND FOR THE METAL BEING WELDED. WELDING MATERIALS SHALL CONFORM TO AWS A5.1, A5.5, A5.17, A5.18, A5.20 AND A5.23 AND SHALL BE E7018, E7028, E8018-C3, F7A2-EXXX, E70T-1, E70T-6 OR E71T-8, EXCEPT WHERE OTHER WELDING MATERIAL OR MATERIAL COMBINATIONS AND RELATED WELDING PROCESSES ARE ACCEPTED. WELDING ELECTRODES WHICH HAVE BEEN DAMPENED OR WHICH HAD BEEN CONTAMINATED BY GREASE OR OTHER SUBSTANCES DELETERIOUS TO WELDING SHALL NOT BE USED IN THE WORK.
8. SHIELDING GAS SHALL BE OF A WELDING GRADE HAVING A DEW POINT OF -40°F (-40°C) OR LOWER.
9. STUD SHEAR CONNECTORS AND CONCRETE ANCHOR STUDS: MATERIAL AND EQUIPMENT FOR WELDED STUDS, STUD SHEAR CONNECTORS AND CONCRETE ANCHOR STUDS SHALL CONFORM TO AWS D1.1.
10. HIGH TENSILE BOLTS, NUTS AND WASHERS SHALL CONFORM TO THE APPLICABLE ASTM SPECIFICATION AS FOLLOWS:

    BOLTS: ASTM A325, TYPE 1 OR ASTM A490, TYPE 1 — NUTS: ASTM A563, DH OR ASTM A194, 2H — WASHERS: ASTM F436

    ALL FASTENER COMPONENTS SHALL BEAR THE MANUFACTURERS MARK; NUTS SHALL BEAR THE DH OR 2H SYMBOL AS APPLICABLE. ALL BOLTS, NUTS AND WASHERS SHALL BE COLD FORGED; BOLTS AND NUTS SHALL HAVE ROLLED THREADS. NEITHER HOT FORGED BOLTS OR NUTS NOR CUT THREADS MAY BE USED IN THE WORK.
    a) IN ADDITION TO THE MANDATORY TESTING PROVIDED IN THE ASTM SPECIFICATION, PROOF LOAD TESTING (F606), CHEMICAL ANALYSIS (A751) AND CERTIFICATION SHALL BE REQUIRED OF MANUFACTURER; FOR GALVANIZED BOLTS, NUTS AND WASHERS, MANUFACTURER'S CERTIFICATION SHALL INCLUDE THE RESULTS OF THE ROTATIONAL-CAPACITY TESTS AS WELL AS THE RESULTS OF THE ZINC THICKNESS MEASUREMENTS. EXCEPT FOR THE ROTATIONAL-CAPACITY TESTS OF GALVANIZED BOLT, NUT AND WASHER ASSEMBLIES, WHICH SHALL BE PERFORMED IN ACCORD WITH THE SHIPPING LOT METHOD, ALL TESTING AND ANALYSIS SHALL BE CONDUCTED IN ACCORD WITH THE PRODUCTION LOT METHOD. TESTING SHALL BE COMPLETED FOR EACH GRADE OF EACH TYPE OF EACH SIZE OF FASTENER. FASTENER COMPONENTS NOT IN FULL CONFORMANCE TO THE APPROPRIATE ASTM SPECIFICATION SHALL NOT BE SHIPPED TO THE WORK.
       i) PROOF LOAD TESTING SHALL BE CONDUCTED ON FULL-SIZE BOLTS AND COMPONENTS NOT ON MACHINED TEST SPECIMENS.
       ii) PROOF LOAD TESTING SHALL BE ACCOMPLISHED USING METHOD 1 (LENGTH MEASUREMENT) OF METHOD F606.
       iii) TESTING SHALL INCLUDE BOTH HARDNESS AND TENSILE STRENGTH.
    b) BOLTS, NUTS AND WASHERS SHALL BE MANUFACTURED BY A MEMBER OF THE INDUSTRIAL FASTENERS INSTITUTE AND SHALL BE PURCHASED DIRECTLY FROM THE MANUFACTURER AND NOT FROM A SECONDARY SOURCE.
    c) ACCEPTED MANUFACTURERS ARE:
       1) LAKE ERIE SCREW CORP.
       2) NUCOR FASTENER
       3) OTHER WHERE ACCEPTED.
    d) DOUBLE NUTS SHALL BE USED FOR ALL FASTENERS DESIGNATED AS FINGER TIGHT.
    e) GALVANIZED BOLTS, NUTS, WASHERS, DTI'S AND INSERTS, AS APPLICABLE, CONFORMING TO ASTM B695, CLASS 50 SHALL BE USED AT ALL SURFACES CONTAINING GALVANIZED MATERIALS AND AT ALL SURFACES EXPOSED TO AMBIENT TEMPERATURES. GALVANIZING SHALL BE UNDERTAKEN ONLY ON A325, TYPE 1 BOLTS AND ON ASTM A563 DH NUTS.
    f) BEVELED WASHERS SHALL BE SQUARE, SMOOTH, AND SHALL BE SLOPED TO PROVIDE CONTACT SURFACES IN FULL BEARING. PROVIDE FOR ALL SLOPES OF 1:20 AND LARGER.
    g) THE DIAMETER OF HOLES IN SPECIAL, BEVELED AND SQUARE WASHERS SHALL NOT EXCEED 1/16" (1600 MM) MORE THAN THE NOMINAL BOLT DIAMETER.
    h) THREAD LUBRICATION SHALL BE JOHNSONS 140 STIK WAX (JOHNSONS 139 FOR GALVANIZED FASTENERS) OR OTHER ACCEPTED LUBRICANT.
11. BOLT TENSION INDICATING DEVICES SHALL BE DIRECT-TENSION INDICATING WASHERS (DTI) OR TENSION CONTROL FASTENERS (TCF).
    a) DIRECT-TENSION INDICATING WASHERS SHALL BE OF DOMESTIC MANUFACTURE, CONTAINING ONLY DOMESTICALLY PRODUCED RAW MATERIALS, CONFORMING TO ASTM F959. ACCEPTED MANUFACTURERS ARE J & M TURNER, INC., BETH-FAST, OR OTHER ACCEPTED BY ENGINEER. PROVIDE EPOXY COATED, GALVANIZED (ASTM B695, CLASS 50) WASHERS FOR SURFACES THAT CONTAIN ASTM A588 STEELS WHICH ARE EXPOSED TO THE WEATHER OR WHICH ARE EXPOSED TO AMBIENT TEMPERATURES.
    b) TENSION CONTROL FASTENERS SHALL CONFORM TO THE APPLICABLE PROVISIONS OF ASTM A325 TYPE I OR TO ASTM A490 TYPE I. BOLTS, NUTS AND HARDENED WASHERS SHALL BE BY A MANUFACTURER WHICH IS IN POSSESSION OF A CURRENT ICBO APPROVAL AND WHICH HAS BEEN ACCEPTED.
       i) NEITHER A490 TYPE 3 NOR A325 TYPE 2 SHALL BE USED IN THE WORK.
12. DEFORMED ANCHOR BARS SHALL BE ASTM A496 DEFORMED BARS PREPARED FOR STUD WELDING AS MANUFACTURED BY ERICO JONES, OR BY NELSON STUD DIVISION OF TRW, OR OTHER ACCEPTED ANCHOR BAR. PROVIDE 1/2 INCH (12 MM) DIAMETER, 36 INCHES (1000 MM) LONG, UNLESS OTHERWISE GIVEN IN THE DRAWINGS.
13. MILLED SURFACES: COAT WITH BLUE LACQUER 1711 BY VARCROFT PAINT CO., MAGNOFILM BY MAGNUS CHEMICAL CO., OR M-2658 BLUE LACQUER BY U.S. STEEL CORP.
14. DRILLED-IN ANCHORS SHALL BE WEDGE-TYPE. CAPSULE-TYPE SHALL NOT BE PERMITTED. DRILLED-IN ANCHORS DESIGNATED IN THE CONTRACT DRAWINGS AS CARRYING A SPECIFIC TENSILE LOAD SHALL BE TENSILE-TYPE.
    a) WEDGE-TYPE: MOLLY PARABOLT BY MOLLY FASTENER, WEDGE ANCHORS BY ITW RAMSET/RED HEAD, HKB KWIK BOLT BY HILTI, RAWL STUD BY THE RAWL COMPANY, OR OTHER WHERE ACCEPTED.
       i) MATERIAL FOR WEDGE-TYPE ANCHORS SHALL CONFORM TO SAE-J429, GRADE 5 OR TO ASTM A325.
    b) TENSILE-TYPE: MAXI BOLT BY DRILLCO DEVICE, LTD., OR OTHER ACCEPTED ANCHOR.
       i) MATERIAL FOR TENSILE-TYPE SHALL CONFORM TO ASTM A193 WITH NUTS AND WASHERS AS SPECIFIED HEREIN FOR ASTM A325 BOLTS.
    c) GALVANIZING SHALL CONFORM TO ASTM B695, GRADE 50 OR TO ASTM B633.
    d) STAINLESS STEEL FOR STUDS AND WASHERS SHALL CONFORM TO AISI GRADE 304 OR GRADE 316 AND TO ASTM F593, GROUP 1 OR GROUP 2. CONDITION SH FOR WEDGE-TYPE ANCHORS. NUTS SHALL BE OF STAINLESS STEEL CONFORMING TO ASTM F594.
15. ANCHOR BOLTS: MAY BE OF UNCOATED STEEL UNLESS OTHERWISE REQUIRED BY THE CONTRACT DRAWINGS, BY *BUILDING CODE* OR BY GOVERNMENTAL AUTHORITIES HAVING JURISDICTION. UNLESS OTHERWISE PROVIDED IN THE CONTRACT DRAWINGS PROVIDE 3/4 INCH (20 MM) DIAMETER OR LARGER.
    a) UNLESS OTHERWISE GIVEN, PROVIDE AS FOLLOWS:
       i) BOLT MATERIAL CONFORMING TO ASTM A572, GRADE 42.
       ii) TWO HEAVY HEX NUTS AS SPECIFIED FOR ASTM A325.
       iii) 3 X 3 X 3/8 (75X75X10 MM), FY 36 (235 MPA) PLATE WASHER.
    b) WHERE DESIGNATED A325, PROVIDE AS FOLLOWS:
       i) BOLT MATERIAL CONFORMING TO ASTM A325 OR TO ASTM A449.
       ii) TWO HEAVY HEX NUTS AS SPECIFIED FOR ASTM A325.
       iii) 3 X 3 X 1/2 (75X75X12 MM), FY 50 (345 MPA) PLATE WASHER.
16. THREAD LOCKING COMPOUND SHALL BE LOC-TITE 242 OR DRI-LOC 20C, AS APPROPRIATE, BY LOC-TITE CORPORATION, PRO-LOCK NUT BY FEL-PRO CORPORATION, OR OTHER ACCEPTED COMPOUND.
17. STEEL DECK SUPPORT SHELVES: PROVIDE ANGLES OF 5/16 INCH (8 MM) MINIMUM THICKNESS AND 3 INCH (75 MM) MINIMUM WIDTH EXCEPT WHERE DIFFERENT SHAPES OR DIMENSIONS ARE ACCEPTED.
18. GRATINGS SHALL BE PROPORTIONED TO RESIST SAFELY THE SUPERIMPOSED LOADS.
    a) FOR PEDESTRIAN LOADING PROVIDE GRIP STRUT, GALVANIZED, PROPORTIONED TO CARRY SAFELY A LIVE LOAD OF NOT LESS THAN 100 PSF (5 KPA).

L. FABRICATION

1. FINISHING SHALL MEAN MILLED TO ASA 250 OR SMOOTHER, UNLESS ANOTHER FINISHING METHOD IS BOTH DESIGNATED IN SHOP DRAWINGS AND ACCEPTED. FINISHED SURFACES SHALL BE PROTECTED BY A CORROSION INHIBITING SUBSTANCE AS PROVIDED HEREIN. FINISH CONTACT SURFACES OF BASE PLATES, COLUMN SPLICES, WHERE INDICATED "FIT TO BEAR", AND AT OTHER LOCATIONS WHERE INDICATED IN THE CONTRACT DRAWINGS.
2. GAS CUTTING: GAS CUTTING, INCLUDING MISCELLANEOUS CUTS, COPES, CUTS FOR WELD ACCESS AND THE LIKE, SHALL PROVIDE SMOOTH, UNIFORM, WORKMANLIKE SURFACES AND SHALL ACHIEVE A 1000 MICRON SURFACE ROUGHNESS OR BETTER AS DEFINED BY ANSI B46.1. EXCEPT WHERE ACCEPTED, GAS CUTTING SHALL BE MACHINE GUIDED; CUTTING BY HAND-GUIDED TOOLS WILL REQUIRE GRINDING. PROVIDE 1/2 INCH (13 MM) MINIMUM RADIUS CUT AT ALL REENTRANT CORNERS EXCEPT WHERE A SMALLER OR LARGER RADIUS FOR SPECIFIC DETAILS IS SHOWN OR NOTED IN THE CONTRACT DRAWINGS OR SPECIFICALLY PROPOSED BY CONTRACTOR AND ACCEPTED IN SHOP DRAWINGS. GAS CUT SURFACES SHALL BE MADE UNIFORM AND NOTCH-FREE BY CHIPPING, PLANING, WELDING AND GRINDING AS REQUIRED, AND SHALL BE VERIFIED BY CONTRACTOR BY FULL VISUAL INSPECTION; WHERE HAND-HELD CUTTING TOOLS ARE USED, AND WHERE REQUIRED BY *AISC SPECIFICATION*, CONTRACTOR SHALL PROVIDE 100% INSPECTION BY DYE-PENETRANT OR BY MAGNETIC PARTICLE.
   a) GALVANIZED MEMBERS: GAS-CUT SURFACES AT RE-ENTRANT CORNERS SHALL BE GROUND TO BRIGHT METAL AND TESTED BY DYE-PENETRANT OR MAGNETIC PARTICLE TESTING PRIOR TO GALVANIZING AND VERIFIED BY CONTRACTOR BY FULL VISUAL INSPECTION AFTER GALVANIZING.
3. STRAIGHTENING: FABRICATED MATERIALS CONTAINING SHARP KINKS OR BENDS SHALL BE REJECTED. MATERIAL STRAIGHTENED PRIOR TO FABRICATION SHALL BE EXAMINED CAREFULLY FOR SIGNS OF DISTRESS AND FOR OTHER DEFECTS BEFORE BEING PLACED IN FABRICATION. DISTRESSED OR OTHERWISE DEFECTIVE MATERIAL SHALL NOT BE USED IN THE WORK. STRAIGHTENING BY THE USE OF PROPERLY CONTROLLED HEAT WILL BE PERMISSIBLE IF DONE BY PERSONNEL SKILLED IN HEAT STRAIGHTENING, USING EQUIPMENT AND TECHNIQUES IN ACCORD WITH WRITTEN PROCEDURE DOCUMENTS AND APPLICABLE DETAIL SKETCHES PREPARED BY THE FABRICATOR AND ACCEPTED BY ENGINEER.
4. GRINDING: SHARP CORNERS, PROJECTIONS, AND SIMILAR ROUGH OR SHARP SURFACES OR EDGES SHALL BE EASED AND SMOOTHED BY GRINDING SO AS TO PROVIDE NOTCH-FREE SURFACES.
5. PREHEAT: WELDING SHALL BE PERFORMED ON MATERIAL PREHEATED TO A TEMPERATURE ABOVE THE DEWPOINT, REGARDLESS OF OTHER PREHEATING REQUIREMENTS. PREHEAT FOR WELDING SHALL BE SOAKED PREHEAT AND SHALL BE VERIFIED BY HEAT SENSITIVE CRAYONS (TEMPILSTIK) OR OTHER ACCEPTED MEANS.
6. WELDING MATERIALS AND PROCESSES SHALL BE SELECTED FROM THOSE NOTED HEREIN AND SHALL CONFORM TO ACCEPTED WELDING PROCEDURE SPECIFICATIONS. WELDING MATERIALS SHALL BE FRESH AND NEW. WELDING ELECTRODES OR FLUX CONTAMINATED BY DELETERIOUS SUBSTANCES OR MOISTURE SHALL NOT BE USED AND SHALL BE REMOVED PROMPTLY FROM THE WORK. LOW HYDROGEN ELECTRODES WHICH CANNOT BE USED PROMPTLY AFTER OPENING OF HERMETICALLY SEALED CONTAINERS SHALL BE STORED IN ELECTRIC HOLDING OVENS AT 250°F (120°C) MINIMUM. ELECTRODES OR FLUX WHICH HAVE BEEN DAMPENED OR CONTAMINATED SHALL BE REMOVED PROMPTLY FROM THE WORK.
7. TACK WELDS: EXERCISE THE SAME DEGREE OF CONTROL IN MAKING TACK WELDS AS REQUIRED FOR STRUCTURAL WELDS, INCLUDING PROVISION OF PREHEAT AND POSTHEAT APPROPRIATE TO THE BASEMETALS JOINED. TACK WELDS WHICH CRACK SHALL BE CUT OR GROUND AND DAMAGED BASE METAL REPAIRED. REMOVE AND GRIND SMOOTH TACK WELDS NOT INCORPORATED INTO PERMANENT STRUCTURAL WELDS.
8. ARC STRIKES: STRAY ARCING BETWEEN ELECTRODES OR OTHER PORTIONS OF THE WELDING SYSTEM AND BASE METAL LOCATIONS OUTSIDE STRUCTURAL WELDS SHALL BE AVOIDED TO THE MAXIMUM EXTENT PRACTICABLE. IN THOSE LOCATIONS WHERE ARC STRIKES DO OCCUR, THE AFFECTED BASE METAL SHALL BE GROUND SMOOTH, OR OTHERWISE REPAIRED, TO REMOVE THE EFFECTS OF THE ARC STRIKE AND ENSURE CONTINUING SOUNDNESS OF THE BASE METAL.
9. SHOP BOLTING WITH ASTM A325 OR ASTM A490 BOLTS SHALL CONFORM TO APPLICABLE PROVISIONS OF THE *AISC SPECIFICATION* AND *SPECIFICATIONS FOR STRUCTURAL JOINTS USING ASTM A325 OR A490 BOLTS* EXCEPT THAT ALL BOLTING PROVISIONS SET FORTH HEREIN SHALL APPLY TO HIGH-STRENGTH SHOP BOLTING.
10. DRAINAGE HOLES: PROVIDE HOLLOW TUBULAR, BOX AND OTHER MEMBERS WITH EFFECTIVE DRAINAGE HOLES EXCEPT WHERE MEMBERS ARE SEALED TIGHT AT CONTRACTOR'S OPTION OR IN ACCORD WITH NOTES AND DETAILS INCLUDED IN THE CONTRACT DRAWINGS. CONTRACTOR IS FULLY RESPONSIBLE TO PROVIDE STEELWORK FREE OF ENTRAPPED WATER AT THE COMPLETION OF THE CONTRACT.

    WHERE ONE END OF A GALVANIZED TUBE IS SPECIFIED TO BE SEALED, PROVIDE A 13/16 INCH DIAMETER HOLE AT THE OPPOSITE END TO PERMIT PRESSURE RELIEF DURING THE HOT DIP PROCESS. WHERE BOTH ENDS ARE SEALED, WELD ONE END PLATE ON THE TUBE AFTER THE GALVANIZING PROCESS.
11. BEAM OPENINGS: PROVIDE OPENINGS AS SHOWN, NOTED OR SCHEDULED IN THE CONTRACT DRAWINGS. PROVIDE HOLES, SLOTS AND OPENINGS REQUIRED FOR PASSAGE OF WORK OF OTHER TRADES TOGETHER WITH NECESSARY REINFORCING. USE SUITABLE TEMPLATES FOR ACCURATE LOCATION OF OPENINGS. WHERE OPENINGS ARE SHOWN IN THE CONTRACT DRAWINGS OR IN SHOP DRAWINGS, CHANGES IN LOCATION WILL NOT BE PERMITTED EXCEPT WHERE ACCEPTED SPECIFICALLY. BEAM OPENINGS NOT SHOWN OR SCHEDULED SHALL BE PROVIDED ONLY WHERE ACCEPTED SPECIFICALLY.
12. BOLT HOLES: DRILL OR PUNCH HOLES AT RIGHT ANGLES TO THE SURFACE OF THE METAL. PROVIDE HOLES NOT MORE THAN 1/16 INCH (1500 μM) LARGER THAN THE CONNECTOR DIAMETER UNLESS OVERSIZE OR SLOTTED HOLES ARE SHOWN OR NOTED IN THE CONTRACT DRAWINGS OR SPECIFICALLY ACCEPTED. DO NOT MAKE OR ENLARGE HOLES BY BURNING. DRILL OR SUB-PUNCH AND REAM MATERIAL WHERE THICKNESS EXCEEDS THE CONNECTOR DIAMETER AND IN ALL MATERIAL THICKER THAN 7/8 INCH (22 MM). HOLES SHALL BE TRUE AND FAIR WITHOUT TORN OR RAGGED EDGES. ELONGATED PUNCH AND DIE SETS SHALL BE USED TO PUNCH ELONGATED HOLES. BURRS SHALL BE REMOVED WITH A TOOL PROVIDING A 1/16 INCH (1500 μM) BEVEL.
13. QUALITY OF WELDS AND BASE METAL: QUALITY OF ALL WELDS SHALL CONFORM TO AWS D1.1, ARTICLE 8.15. WHEN EXAMINED BY UT, PARTIAL AND COMPLETE PENETRATION WELDS SHALL CONFORM TO AWS D1.1, TABLE 8.2. CRACKING OR INCOMPLETE PENETRATION SHALL BE CAUSE FOR REJECTION OF EACH WELD POSSESSING SUCH DEFECTS, REGARDLESS OF OTHER ACCEPTANCE OR REJECTION CRITERIA. BASE METAL CONTAINING GROSS DISCONTINUITIES BEFORE OR AFTER WELDING OR LAMELLAR TEARING AFTER WELDING SHALL BE REPAIRED IN ACCORD WITH PROCEDURES ACCEPTED BY ENGINEER OR SHALL BE DISCARDED AND REPLACED.
    a) PROVIDE MATERIAL THICKNESS AND WIDTH TRANSITIONS IN ACCORD WITH DETAILS IN THE CONTRACT DRAWINGS WHERE SHOWN, AND IN ACCORD WITH THE PROVISIONS OF AWS D1.1, ARTICLE 9.20.
    b) PROVIDE WELD ACCESS HOLES OR CUTS IN ACCORD WITH DETAILS SHOWN IN THE CONTRACT DRAWINGS, THE PROVISIONS OF AWS D1.1, THE PROVISIONS OF THE *AISC SPECIFICATION* AND THE GAS CUTTING PROVISIONS CONTAINED HEREIN. PLUG ACCESS HOLES WITH DEFECT-FREE WELD METAL WHERE SEALED MEMBERS ARE REQUIRED.
14. BRITTLE FRACTURE: CONTRACTOR SHALL TAKE ALL MEASURES NECESSARY TO MINIMIZE THE OCCURRENCE OF BRITTLE FRACTURE. MEASURES SHALL INCLUDE PROPER MATERIALS SELECTION, FABRICATION TECHNIQUES AND THE LIKE.
    a) BOTH BASE METAL AND WELDING MATERIALS SHALL PROVIDE ADEQUATE NOTCH TOUGHNESS.
    b) STRESS CONCENTRATIONS SHALL BE MINIMIZED BY CAREFULLY CONTROLLING NOTCHES AND BY CONTROLLING WELD DEFECTS SUCH AS LACK OF FUSION AND COLD CRACKING. STRESS RELIEF HOLES SHALL BE PROVIDED AT ALL WELDED WEB-TO-FLANGE INTERFACES FOR SHAPES WITH FLANGE THICKNESS IN EXCESS OF 1.0 INCHES (25 MM).
    c) WELDS, INCLUDING MULTIPLE-PASS WELDS SHALL BE COMPLETED IN A SINGLE OPERATION, WITHOUT INTERRUPTION.
    d) COOLING RATES AND NON-UNIFORMITY OF COOLING OF WELDS SHALL BE REDUCED BY PROPER INSULATING BLANKETS AND, WHERE NECESSARY, BY POST-HEATING.
    e) EXCESSIVE ELEVATION OF WELDING TEMPERATURES SHALL BE AVOIDED. PRACTICES SUCH AS THE SIMULTANEOUS WELDING OF BOTH SIDES OF A STIFFENER WITHIN THE BOSOM OF A WIDE FLANGE SHAPE SHALL NOT BE ALLOWED.
    f) PROVIDE AND THEN REMOVE RUN-ON AND RUN-OFF TABS AT ALL LOCATIONS WHERE START-UP OR TERMINATION PORTION OF WELD MAY CREATE A STRESS RAISER.
    g) PARTICULAR CARE SHALL BE TAKEN TO ELIMINATE COLD CRACKING.
       i) PRE-HEAT AND POST-HEAT CONDITIONS SHALL BE PROVIDED NOT LESS THAN AS PROVIDED IN TABLE 3.2-1. IN USING THIS TABLE, THE CARBON EQUIVALENT OF THE STEEL SHALL BE TAKEN BY THE IIW MERCURY METHOD AS:

          $$CE = C+MN/6+(CU+NI)/15+(CR+MO+V)/5$$

       ii) THE VALUES GIVEN IN TABLE 3.2-1 ASSUME WELDING ELECTRODES TO BE OF THE LOW HYDROGEN TYPE, THOROUGHLY BAKED, AND THAT RUST AND OIL IN WELDING GROOVES IS NOT PRESENT. NOTE THAT SUFFICIENT PRE-HEATING, WITH LOWER HEATING RATE AND WIDER PRE-HEATED ZONE IS REQUIRED IN ORDER TO KEEP INTERPASS TEMPERATURES ABOVE MINIMUM VALUES, PARTICULARLY WHERE HEAVIER SECTIONS ARE BEING WELDED.
       iii) WELD COOLING RATE SHALL BE CONTROLLED SO AS TO REDUCE RESIDUAL STRESSES CAUSED BY WELDING AND TO ENHANCE HYDROGEN EVOLUTION.
       iv) WELDING AT AMBIENT TEMPERATURES BELOW 32°F (0°C) SHALL NOT BE ACCOMPLISHED WITHOUT PRIOR ACCEPTANCE.
    h) TAKE SPECIAL CARE TO GRIND COPES, ACCESS HOLES AND OTHER CUTS SO AS TO IMPROVE THE SURFACE AND TO REDUCE THE POTENTIAL FOR NOTCH FORMATION.

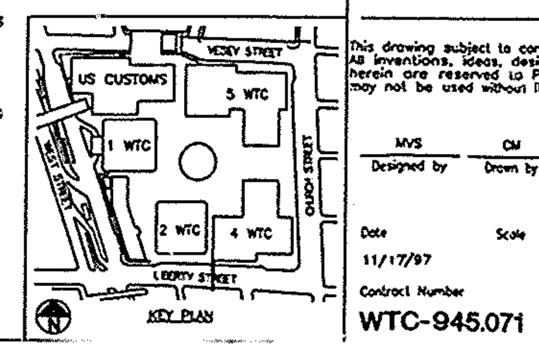
TABLE 3.2-1

PREHEAT AND POSTHEAT CONDITIONS FOR WIDE FLANGE SHAPES

CE (IIW)	FLANGE THICKNESS: < 1-1/2 IN (38 MM)	≥ 1-1/2 IN (38 MM)	≥ 2 IN (50 MM)	≥ 3 IN (75 MM)	≥ 4 IN (100 MM)
≤ 0.38	–		PREHEAT ≥ 350°F		
≤ 0.40			INTERPASS ≥ 125°F		
≤ 0.42	PREHEAT ≥ 125°F			PREHEAT ≥ 350°F INTERPASS ≥ 125°F	
≤ 0.44	INTERPASS ≥ 125°F	PROVIDE IMMEDIATE POSTHEAT BETWEEN 350°F AND 600°F FOR MORE THAN 10 MINUTES			
≤ 0.46				PREHEAT ≥ 350°F INTERPASS ≥ 125°F	
≥ 0.46			PROVIDE IMMEDIATE POSTHEAT BETWEEN 350°F AND 600°F FOR MORE THAN 60 MINUTES		

NOTE: 125°F = 52°C, 350°F = 177°C, 600°F = 316°C

15. WELD INSPECTION: CONTRACTOR SHALL PROVIDE FULL SHOP AND FIELD INSPECTION TO ASSURE THAT ALL WELDING CONFORMS TO THE REQUIREMENTS OF CONTRACT DRAWINGS AND SPECIFICATIONS. GOVERNING DOCUMENTS INCLUDE, BUT ARE NOT LIMITED TO CONTRACT DOCUMENTS, *BUILDING CODE* AND ANSI/AWS D1.1. ALL INSPECTIONS SHALL ASSUME THAT WELDS ARE IN TENSION, WITH DIRECTION OF STRESS IN MOST CRITICAL DIRECTION (FOR EXAMPLE, TRANSVERSE TO UNDERCUT).
16. RUNON AND RUNOFF TABS SHALL BE REMOVED AND THE SURFACE MADE SMOOTH PRIOR TO VISUAL AND NON-DESTRUCTIVE TESTING AND PRIOR TO SHIPPING STEEL TO THE CONSTRUCTION SITE. TABS FOR FIELD WELDS SHALL BE REMOVED AT ALL LOCATIONS WHERE REQUIRED OR DIRECTED.
17. CLEAN, PAINT AND GALVANIZE STEEL AS PROVIDED HEREIN. DO NOT PAINT STEEL EXCEPT WHERE PROVIDED SPECIFICALLY HEREIN OR IN THE CONTRACT DRAWINGS.



THE PORT AUTHORITY OF NY & NJ

ORIGINAL SIGNED & SEALED BY N.Y. P.E. (OR R.A.)

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Tel: (212) 563-7400, Fax: (212) 563-7382

THE OFFICE OF DAVID ELLIOT LEBOWITZ
ARCHITECTS + PLANNERS

LESLIE E ROBERTSON ASSOCIATES, R.L.L.P.
CONSULTING STRUCTURAL ENGINEERS

I HEREBY CERTIFY THAT THIS IS A TRUE AND CORRECT COPY OF ONE OF THE CONTRACT DRAWINGS CONSTITUTING A PART OF CONTRACT NO. WTC-945.071 IN THE FORM IN WHICH SAID DRAWINGS EXISTED AT THE TIME THE SAID CONTRACT WAS EXECUTED BY THE PARTIES.

DATE 1/16/98 [signature] SPEC. WRITER

DATE 4/10/98 P.K. [signature] ENGINEER OF DESIGN

No.	Date	Revision	Approved
△	11/17/97	ISSUED FOR BID	

Engineering Department
Design Divisions

The World Trade Center

STANDBY POWER
5 WORLD TRADE CENTER

STRUCTURAL

GENERAL NOTES

This drawing subject to conditions in contract. All inventions, ideas, designs and methods herein are reserved to Port Authority and may not be used without it's written consent.

Designed by	Drawn by	Checked By
MVS	CM	RZ

Date 11/17/97 Scale

Contract Number WTC-945.071 Drawing Number S0-03